Field Sampling Plan for Groundwater Monitoring of Operable Unit 7-13/14

1. INTRODUCTION

1.1 Purpose

The work described in this field sampling plan (FSP) will be used to support the objectives of several programs at the Idaho National Engineering and Environmental Laboratory (INEEL) including (1) the Waste Area Group (WAG) 7 Operable Unit (OU) 7-13/14 comprehensive remedial investigation and feasibility study (RI/FS), (2) the active low-level waste disposal operation, (3) long-term stewardship, and (4) subsurface sciences at the Radioactive Waste Management Complex (RWMC). In addition, it will be used to support the activities of INEEL oversight groups.

The sampling and analysis plan for this work consists of (1) the FSP and (2) the *Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10 and Inactive Sites* (QAPjP) (DOE-ID 2000). The FSP has been prepared in accordance with INEEL Environmental Restoration (ER) management control procedures (MCPs) (see Section 8) and guidance from the U.S. Environmental Protection Agency (EPA) document, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988). The FSP governs groundwater sampling that began during the fourth quarter of Fiscal Year 2001 and describes the field activities that will take place as part of the investigation. The QAPjP describes the processes and programs that will ensure that the data generated will be suitable for their intended use.

1.2 Scope of Work

The scope of this plan is limited to collecting and analyzing samples of the groundwater directly beneath and in the vicinity of the SDA as defined by the *Work Plan for Operable Unit 7-13/14 Waste Area Group 7 Comprehensive Remedial Investigation/Feasibility Study* (Becker et al. 1996). Monitoring-well locations are detailed in Section 3.

As part of the INEEL ER Program's routine monitoring project, groundwater monitoring wells located near and inside the RWMC are being sampled on a periodic basis. As part of this project, groundwater samples routinely will be collected from RWMC-area wells. The objectives of this investigation are to (1) monitor groundwater quality, (2) identify any degradation of groundwater quality that may originate from the RWMC subsurface, and (3) provide groundwater data that will aid in characterizing the spatial extent of contamination via the groundwater pathways downgradient of the RWMC. These data will (1) aid in the understanding of fate and transport of contaminant migration from the RWMC, (2) help fill previously identified data gaps, and (3) support the selection of appropriate remedial alternatives.

1.3 Idaho National Engineering and Environmental Laboratory Site Background

The INEEL is located in the northwestern portion of the Eastern Idaho Snake River Plain in southeast Idaho, approximately 34 mi (54.7 km) west of Idaho Falls, Idaho, and encompasses 890 mi^2 (2,305 km^2). Figure 1 shows the location of INEEL and the WAG 7 area. Figure 2 shows the INEEL in relation to the Snake River Plain Aquifer. The WAG 7 encompasses the RWMC which is located in the southwest quadrant of the INEEL and includes (1) the Subsurface Disposal Area (SDA), (2) the Transuranic (TRU) Storage Area (TSA), a storage area for TRU waste, and (3) an operations and administration area that provides miscellaneous support operations. Additional INEEL and WAG 7 background and descriptions are detailed in the OU 7-13/14 RI/FS Work Plan (Becker et al. 1996) and the *Addendum to the Work Plan for the Operable Unit 7-13/14 Waste Area Group 7 Comprehensive Remedial Investigation/Feasibility Study* (DOE-ID 1998).

The OU 7-13/14 comprehensive RI/FS will involve evaluation of past releases associated with WAG 7 listed in the *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory* (FFA/CO) (DOE-ID 1991). Sampling is required to fill data gaps for groundwater identified during preparation of the *Interim Risk Assessment and Contaminant Screening for the Waste Area Group 7 Remedial Investigation* (IRA) (Becker et al. 1998). Sampling results from previous soil gas investigations (Sondrup and Martian 1995; Housley 2001) indicate the presence of volatile organic compounds (VOCs) including high concentrations of carbon tetrachloride, with lesser amounts of chloroform and trichloroethene in the vadose zone and aquifer that warrant further groundwater investigations. Comprehensive INEEL historical and geological information relevant to the RWMC is provided in the *Summary of the Radioactive Waste Management Complex Investigations Report* (Bargelt et al. 1992).

1.4 Radioactive Waste Management Complex Facility Description

The RWMC is located in the southwestern corner of the INEEL (as depicted in Figure 1) and occupies 174 acres (70 ha). The RWMC fence defines the facility boundaries. In 1952, the Atomic Energy Commission selected the RWMC as a waste disposal site for solid low-level radioactive waste. In addition to waste generated at the INEEL, waste from other U.S. Department of Energy (DOE) facilities are stored and disposed of at the RWMC.

The SDA (shown in Figure 3) comprises all property from the center of the RWMC westward and is surrounded by a soil berm and drainage channel. The site was initially established in July 1952 as the Nuclear Reactor Testing Station Burial Ground on 13 acres (5 ha). The facility was expanded incrementally over the years and from 1988 has covered 96.8-acre (39.2-ha). The SDA is a radioactive waste disposal site. Transuranic and low-level waste have been buried in pits, trenches, soil vaults, and one aboveground pad since 1952. The waste contains other nonradioactive hazardous materials such as mercury, beryllium, asbestos, zirconium fines, solidified acids and bases, solvents and degreasing agents, and sodium and potassium salts.

The TSA is a 56-acre (22.6-ha) facility located in the southern portion of the RWMC. The TSA was established in 1970 as an interim storage facility when subsurface disposal of waste containing TRU concentrations greater than 100 nCi/g in the SDA was discontinued. Operations at the TSA include waste segregation, examination, and certification in addition to interim storage.

The operations and administration area contains administrative offices, security and gatehouse operations, radiological control support, maintenance buildings, equipment storage, and miscellaneous support facilities. A more detailed summary of RWMC operations is provided in the IRA.

The current mission of the RWMC is to provide waste management for the present and future needs of the INEEL and of assigned DOE off-site generators of low-level and TRU waste, and to retrieve, examine, and certify stored TRU waste for ultimate shipment to the DOE Waste Isolation Pilot Plant near Carlsbad, New Mexico.

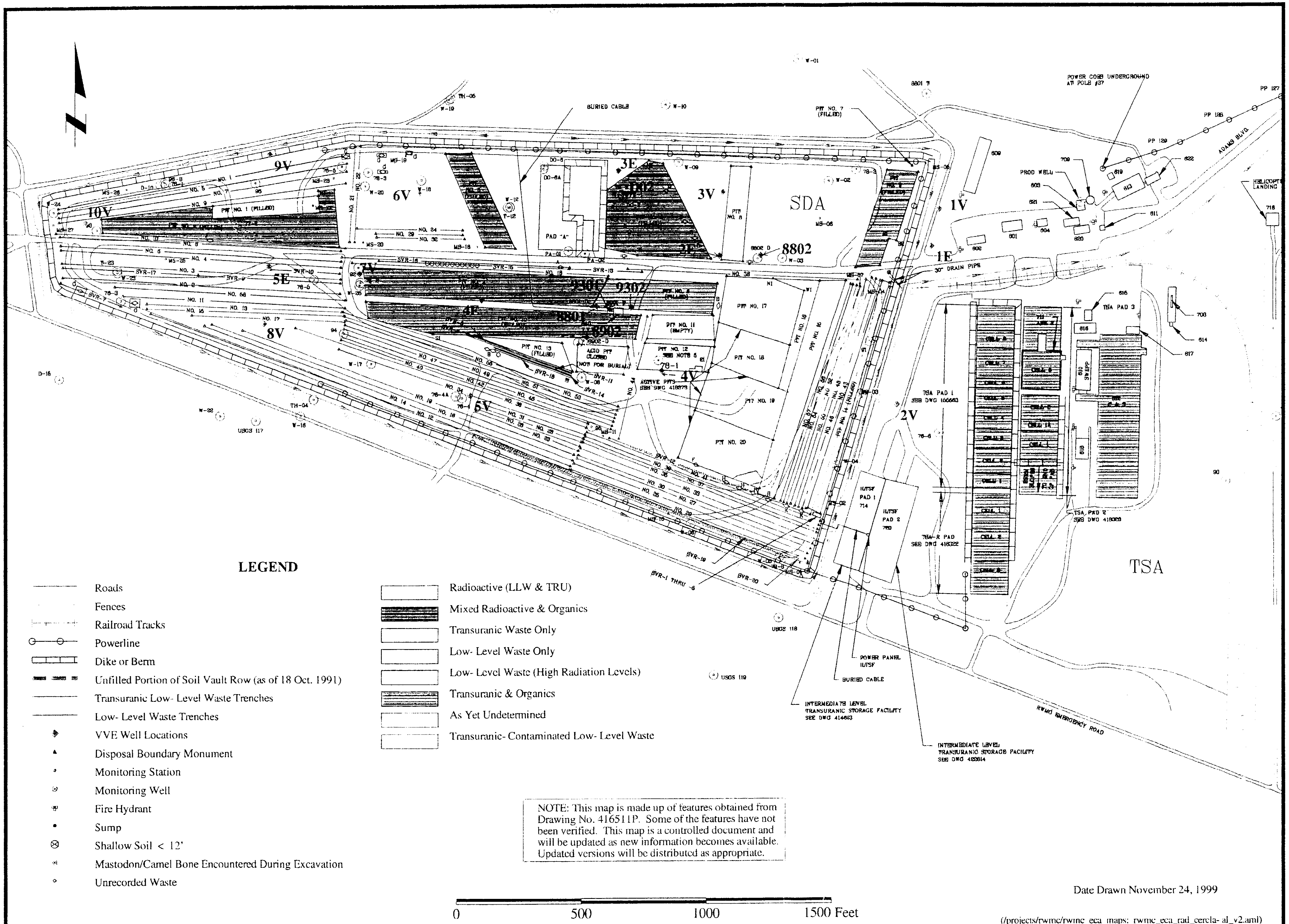

Figure 3. Subsurface Disposal Area at the Radioactive Waste Management Complex.

1.4.1 Conceptual Site Model

A conceptual site model for the SDA, displayed in Figure 4, was developed to help focus data collection efforts at the RWMC (Becker et al. 1998). This model identified the exposure pathways, exposure routes, and receptor locations that may be important at the SDA, and illustrated the mechanisms through which human receptors could be exposed. In accordance with the IRA, groundwater exposure pathways will be of significant relevance to potential future risk.

1.4.1.1 Primary Contaminant Sources and Release Mechanisms. The primary sources of contamination are contaminated clothing, contaminated equipment, and chemicals disposed of in the SDA. Primary release mechanisms to groundwater include migration and seepage from the SDA, corrosion, diffusion from the waste, and surface wash-off (Becker et al. 1998). Initial leaching of the contaminants will occur by liquid transport and dissolution. This is affected by the speciation of radionuclides and other contaminants in the pore water.

1.4.1.2 Secondary Contaminant Sources and Release Mechanisms. Secondary sources are contaminated subsurface soils at the SDA. Potential secondary release mechanisms to groundwater include volatilization and infiltration or leaching. It is possible that the flooding events in 1962 and 1969 were release mechanisms. Initial leaching of the contaminants will occur by liquid transport and dissolution. Contaminants present in the surface soils may have been transported away from the SDA during flooding. Subsequent infiltration and leaching after surface transport may have occurred.

1.4.2 Pathways

An exposure pathway is the route of a contaminant from the source to the receptor. The Snake River Plain Aquifer is not a source, but rather a pathway. Therefore, the information gathered in this investigation will be used to support the evaluation of risk from the groundwater pathway during other WAG 7 RI/FS investigations outlined in the FFA/CO for WAG 7.

1.4.2.1 Groundwater. Continued infiltration may ultimately result in the transport of contaminants to the aquifer and then the contaminants may migrate downgradient as shown in Figure 5 (Holdren et al. 1999). Groundwater flow near the RWMC is complicated because of periodic recharge from the spreading areas located to the south and west of the RWMC and the presence of a low-permeability region that apparently exists immediately south and southwest of the SDA (Wylie and Hubbell 1994). When significant, this recharge can change the direction of local groundwater flow.

1.4.3 Exposure Routes and Receptors

Receptors are human and terrestrial biota that could be exposed to contaminants via the identified pathway. The potential receptors could be INEEL employees, visitors, future residents, and terrestrial biota. Receptors could be exposed through ingestion and inhalation.

Human receptors are divided into two groups based on the time spent at the site. The RWMC workers are at the site 40 hours per week and may be exposed from the RWMC production well. Visitors spend no more than 40 hours per week and usually less than 10 hours per day at the site but may also be exposed to the RWMC production well. Future residents of the area may also be exposed via ingestion and inhalation.

Terrestrial biota includes desert animals and birds, migratory waterfowl, reptiles, and amphibians as well as terrestrial plants and grasses. Exposure to these receptors is not likely and will not be included as part of the routine analysis.

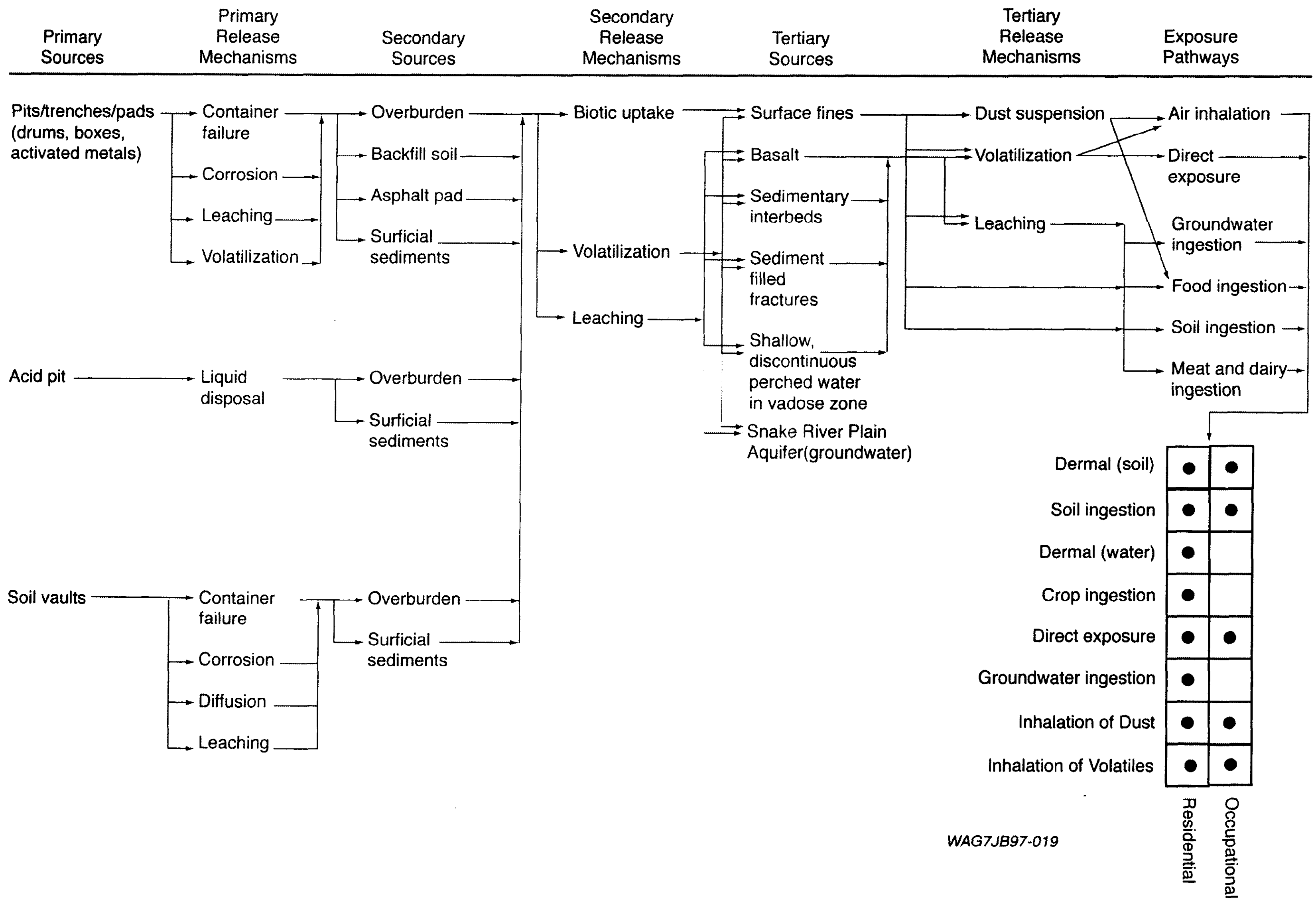

Figure 4. Conceptual site model for the Subsurface Disposal Area.

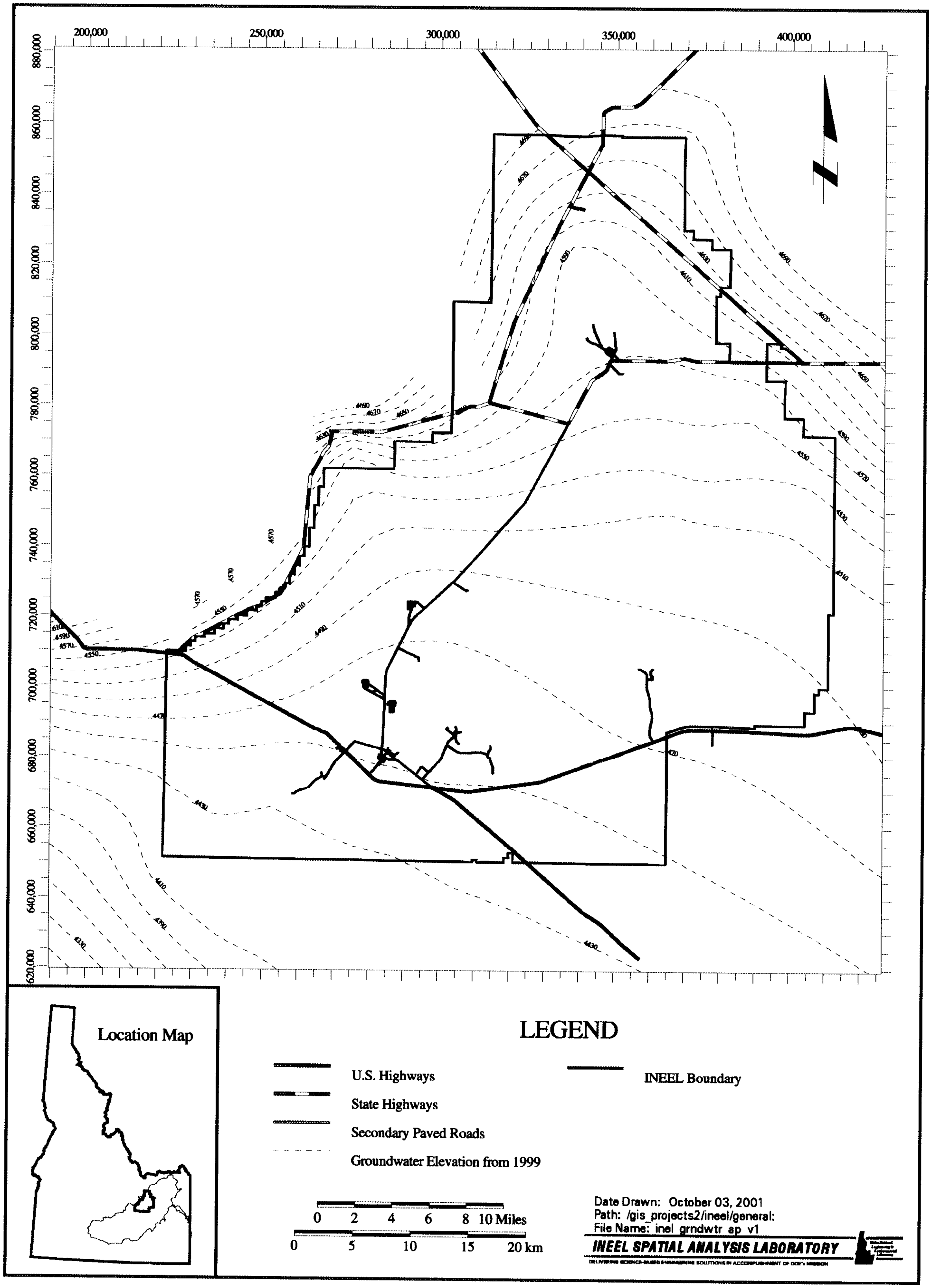

Figure 5. Map of the Idaho National Engineering and Environmental Laboratory showing generalized groundwater flow lines of the Snake River Plain Aquifer.

1.5 Existing Data

Beginning in 1992, RWMC groundwater monitoring wells have been sampled routinely for VOCs, metals, nitrates, and radionuclides. Carbon tetrachloride has been detected in Wells M3S and M6S but at levels well below drinking water standards (5 ppb). Carbon tetrachloride has also been detected in Wells M7S and M10S at levels closer to and sometimes exceeding the drinking water standards. Trichloroethene has been detected in Wells M3S and M7S but at levels significantly below maximum contaminant levels (5 ppb). All RWMC wells are still being monitored for any apparent trends in these contaminants.

The SDA includes a variety of contaminant sources. The OU 7-13/14 RI/FS Work Plan and the IRA contain various RWMC-area transport media sample data from previous investigations. The *Waste Area Group 7 Operable Unit 7-13/14 Data Quality Objectives Report* (Day et al. 2001) provides a contaminant-screening summary. The retained contaminants of potential concern are recommended for evaluation during the OU 7-13/14 comprehensive RI/FS baseline risk assessment.

Appendix A contains the as-built details for the monitored wells except for the wells installed and routinely sampled by the U.S. Geological Survey (USGS). Data from USGS wells and from USGS samples collected at OU 7-13/14 newly installed wells will be used in conjunction with the data generated during WAG 7 groundwater sampling activities for the OU 7-13/14 comprehensive RI/FS.

1.5.1 Identification of Data Gaps

The hydrogeology of the INEEL has been studied by the USGS and others for more than 50 years. Groundwater studies specific to the SDA at the RWMC have been conducted since 1971. The OU 7-13/14 RI/FS Work Plan, the OU 7-13/14 RI/FS Work Plan Addendum (DOE-ID 1998), and the OU 7-13/14 Data Quality Objective (DQO) Report (Day et al. 2001) list OU 7-13/14 data gaps for groundwater and contaminant pathways that inhibit a comprehensive understanding of site hydrogeology. The groundwater data gaps are listed below:

- Extent of horizontal and vertical groundwater contamination near the SDA are poorly defined
- Potential sources of contamination upgradient of the SDA have not been defined and evaluated
- Distributions and concentrations of radiochemical, organic, and inorganic contaminants in groundwater have not been fully evaluated.

Groundwater monitoring sampling results should help fill the above data gaps.

2. SAMPLING OBJECTIVES

The sampling objectives for the OU 7-13/14 groundwater monitoring project are based on the DQOs described in the OU 7-13/14 DQO Report (Day et al. 2001) and prepared in accordance with the EPA DQO process (EPA 1994). The overall objectives of the DQOs are to define the scope of the data collection activities associated with the OU 7-13/14 comprehensive RI/FS and to formally document the process for defining scope. Groundwater monitoring was identified as a data collection activity.

Waste buried in the SDA of OU 7-13/14 may adversely impact the air, soil, groundwater, surface water, and biota in WAG 7 now or in the future. The nature (i.e., radioactive and nonradioactive contaminants) and extent of this contamination and potential risks have been evaluated to some degree but data gaps remain that require additional data collection.

The DQOs for the OU 7-13/14 groundwater monitoring project include the following:

- Refine the vertical extent of contamination
- Refine the lateral extent of contamination
- Define the future extent (both vertical and lateral) of contamination.

The groundwater monitoring data are relevant to four of the 10 principal study questions (Day et al. 2001):

- Is the current vertical extent adequately defined?
- Is the current lateral extent adequately defined?
- Is the future extent adequately defined?
- Is information adequate to identify process options to address waste conditions?

The data from the OU 7-13/14 groundwater monitoring project will be used to partially fill the current data gaps and this new information will be used to support the WAG 7 comprehensive RI/FS, record of decision, and remedial design and action.

3. SAMPLING LOCATION AND FREQUENCY

Sixteen RWMC-area groundwater monitoring wells will be sampled quarterly. The number and types of all samples (including quality assurance and quality control [QC]) are contained in the sampling and analysis plan table in Appendix B. The routinely sampled wells consist of the following 15 wells located outside the SDA:

- M1S
- M3S
- M4D
- M6S
- M7S
- M10S
- M11S
- M12S
- M13S
- M14S
- M15S
- M16S
- USGS-127
- OW-2
- A11A31.

One well that is sampled routinely is located inside the SDA (i.e., M17S).

Figure 6 shows the locations of these wells. All groundwater sampling will be conducted using the guidelines in Sections 4 through 7.

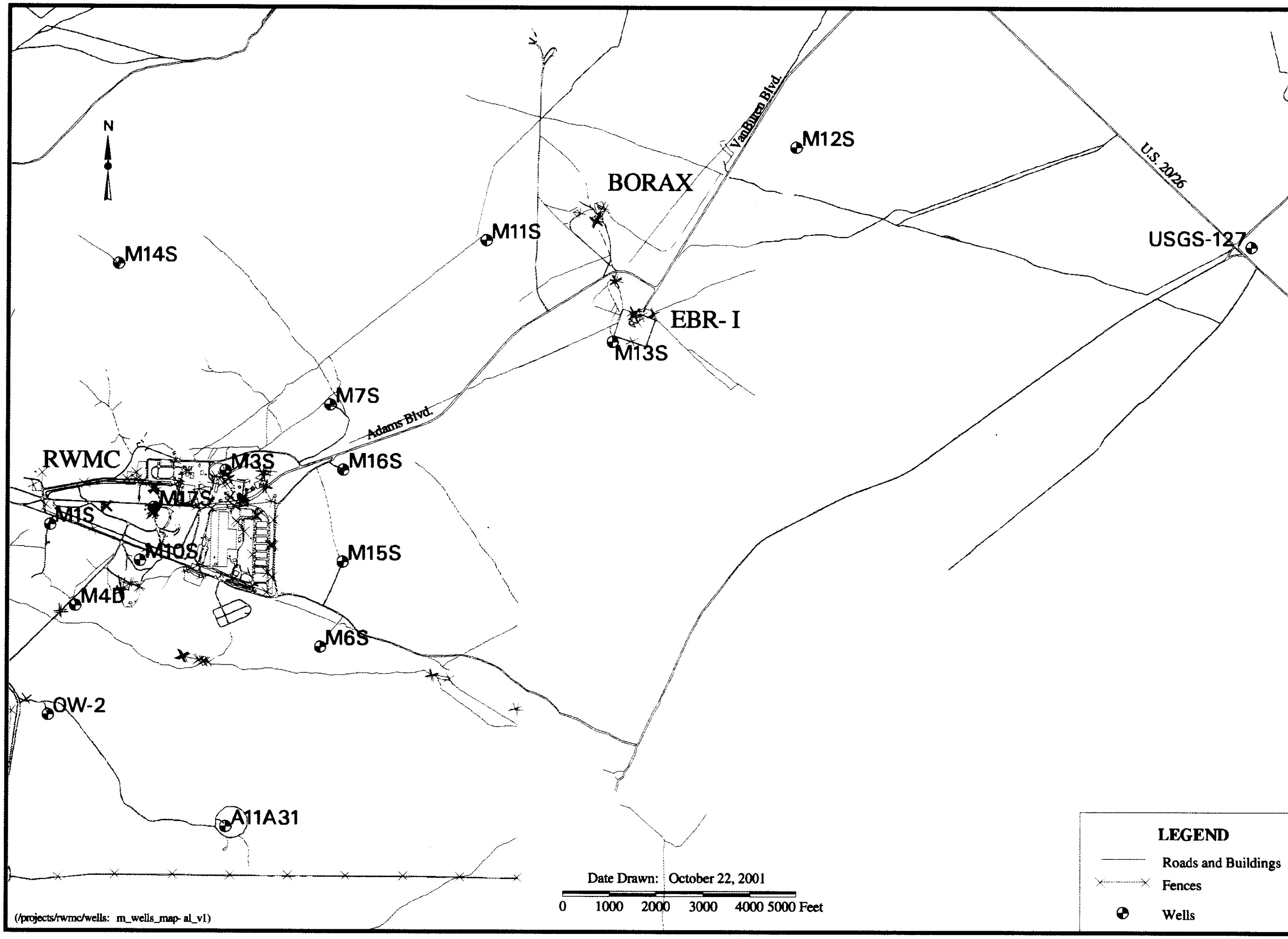

Figure 6. Location of Radioactive Waste Management Complex groundwater monitoring wells.

4. SAMPLE DESIGNATION

A systematic 10-character sample designation code will be used to uniquely identify all samples. The uniqueness of the number will maintain consistency and ensure that no two samples will be assigned the same identification code. The sample numbers will be assigned by the INEEL Sample Management Office (SMO). The integrated environmental data management system is used to ensure the uniqueness of sample identification.

The first three characters identify the project and where the sample was collected for the WAG project. The next three characters designate the sequential sample location for the project. The following two characters designate the sample type (i.e., original or duplicate). The last two characters designate the analysis code, including the analysis and container type. For example, the number "RISK3801RH" from the OU 7-13/14 groundwater-monitoring project will indicate the following information:

- "RIS" designates the sample as originating from WAG 7 in support of groundwater sampling
- "K38" designates the sequential sample number
- "01" designates the sample type (i.e., 01 = original sample versus 02 = field duplicate)
- "RH" designates the sample analysis as radiological suite 1.

The sampling and analysis plan table in Appendix B details the different types of analysis.

5. SAMPLING EQUIPMENT AND PROCEDURES

The RWMC groundwater monitoring wells will be sampled for the analyses shown in the sampling and analysis plan table in Appendix B. The wells will be sampled in accordance with Technical Procedure (TPR) -6570, "Sampling Groundwater," and directions under MCP-227, "Sampling and Analysis Process for CERCLA and D&D&D Activities," and MCP-2725, "Field Work at the INEEL." These procedures have been approved by the RWMC operational safety board and the nuclear facility manager. Sampling activities at the RWMC must be scheduled at the plan-of-the-day meeting at least 1 week prior to the planned sampling initiation date. Sampling will be coordinated with USGS personnel whenever possible.

5.1 Sample Collection

The following sections detail the procedures that occur before groundwater sampling:

- Sample site preparation
- Field measurements
- Well purging.

5.1.1 Sample Site Preparation

All required documentation and safety equipment will be assembled at the well sampling site including radios, fire extinguishers, personal protective equipment (PPE), containers and sampling accessories in accordance with TPR-6570. Additional safety equipment will be used in accordance with the *Waste Area Group 7: Health and Safety Plan for the Routine Monitoring of Operable Unit 7-13/14* (HASP) (Dooley and Barrie 1998).

Before sampling, a prejob briefing will be conducted by the field team leader (FTL) in accordance with MCP-3003, "Performing Pre-Job Briefings and Post-Job Reviews." This allows the sampling team to familiarize themselves with work control processes and safety hazards associated with the job. All sampling personnel will read and familiarize themselves with the sampling and analysis plan (i.e., this FSP and the QAPjP [DOE-ID 2000]) and the OU 7-13/14 HASP for Routine Monitoring (Dooley and Barrie 1998). The FTL will assign a team member to maintain document control and note this appointment in the appropriate logbook (i.e., sample logbook or FTL logbook).

All sampling equipment that contacts the sample media will be cleaned in accordance with TPR-6575, "Decontaminating Sampling Equipment in the Field," and TPR-6541, "Decontaminating Sampling Equipment," except the dedicated submersible sampling pumps and dedicated sampling manifolds. The only equipment anticipated to require decontamination for this project is the water-level recorder and the portable sampling manifold.

5.1.2 Field Measurements

Once the work control zone has been established, the RWMC groundwater monitoring wells will be accessed in accordance with MCP-9279, "Controlling Groundwater Monitoring Well Keys," and inspected in accordance with TPR-6561, "Inspecting Monitoring Wells." In accordance with the OU 7-13/14 HASP for Routine Monitoring (Dooley and Barrie 1998), appropriate PPE will be donned and the depth-to-water will be measured in accordance with TPR-6566, "Measuring Groundwater Levels." Water levels will be measured at each well before purging. A post-sampling water level measurement is not required. Water level data will be used to determine hydraulic gradients and the direction of groundwater flow below RWMC. In lieu of an inline flow meter, flow rates will be determined manually using a 5-gal (19-L) graduated bucket and stopwatch as described in TPR-6570.

Table 1 lists specific well information based on past sampling events (e.g., current water level and well completion data). All calculations will be recorded on a well purging data form shown in TPR-6570, Appendix B.

5.1.3 Well Purging

Each of the RWMC-area groundwater monitoring wells has dedicated pumps and 6-in. (15-cm) stainless steel well casings. The pump inlets (actual sampling depth) were placed approximately 7 ft (2 m) above the bottom of each well screen. Purge volumes, which are based on the depth to water measurement and the bottom of the well casing, will be calculated using the formula in TPR-6570. The Hydrolab or equivalent will be calibrated in accordance with the Hydrolab (1998) *User's Manual* or equivalent and in accordance with TPR-6539, "Standardizing and Using the Hydrolab Datasonde 4 Water Quality Multiprobe," before sampling activities occur. During the purging operation a Hydrolab will be used to measure specific conductance, pH, dissolved oxygen, temperature, and flow rate of the purge water. Post-sampling calibration is designed to confirm the initial calibration and ensure that sensors are functioning properly. If there are temperature extremes, the FTL may determine that calibration should be performed more frequently.

Initial readings for specific conductance, pH, dissolved oxygen, temperature, and flow rate will be collected just after purging begins and readings will be recorded at regular intervals thereafter. The flow rate will be noted in the sample logbook. All Hydrolab readings will be recorded on the well purging data form in TPR-6570, Appendix B. Readings for total dissolved solids that are 65% of the conductivity reading will be recorded on the same form. The water parameters will provide a check on the stability of the water sampled over time.

Each well will be pumped until a minimum of three well casing volumes have been removed and the water produces three consecutive samples for which the deviation of pH, temperature, specific conductance, and color meet the following criteria:

- pH: ± 0.1 standard units
- Temperature: ± 0.5°C
- Specific conductance: ± 10 mmhos/cm
- Color: no visually discernible difference.

Note: Dissolved oxygen is a highly unstable water parameter that is easily compromised by fluctuations in the pumping rate. Unlike the parameters above, dissolved oxygen does not have to be stable before sample collection.

If the four water parameters are not stable after three well casing volumes have been removed, pumping will continue until stabilization is achieved or until a maximum of five casing volumes have been removed. If parameters are still not stable after five volumes have been removed, samples will be collected and appropriate notations will be recorded in the logbook. If the well is pumped dry, samples will be collected as soon as the well has recovered enough water to fill the required sample bottles.

Table 1. Specific Radioactive Waste Management Complex well information.

Well	Installation Date[a]	Screened Interval	Total Depth (ft)	Well Casing (in.)	Depth to Water[b] (ft)	Purge Volume[c] (gal)	Flow Rate[d]
M1S	October 1992	608 to 638	678	6	586.56	226	5 gpm
M3S	October 1992	602.8 to 632.8	660	6	589.65	190	5 gpm
M4D	October 1992	798 to 828	838	6	596.36	102	18 gpm
M6S	October 1992	642 to 668	696.5	6	640.74	120	4 gpm
M7S	October 1992	598 to 628	638	6	578.85	216	5.5 gpm
M10S[e]	October 1992	617 to 647	678	6	595.65	230	5.5 gpm
OW-2	1993	None[f]	1,000	8	619	2,770	12 gpm
A11A31	1993	635 to 675	683	4	638.5	61	1.5 gpm
M11S	May 1998	604 to 624	626	6	567	239	6 gpm
M12S	May 1998	548 to 568	585	6	533	222	6 gpm
M13S	May 1998	623.1 to 643.1	645	6	599	184	5.5 gpm
M14S	May 1998	624.6 to 634.6	645	6	600	172	6 gpm
M15S	2000	600 to 620	653	6	588	138	9 gpm
M16S	2000	578 to 598	663	6	573	328	10 gpm
M17S	2000	598 to 628	665	6	578	191	20 gpm
USGS-127	2000	496 to 596	596	6	504	385	20 gpm

a. All installation data are from the Hydrogeologic Data Repository Information database (INEEL 2000).

b. Depth-to-water data represent the October 2000 sampling event.

c. Purge volumes are based on calculating the water column (i.e., subtracting depth-to-water from depth-to-bottom of the well casing). These data are based on three well volumes.

d. Flow rates may vary during purging. Data listed are averages based on the October 2000 sampling event.

e. Well M10S is currently inoperable.

f. There is no screened interval. Well OW-2 was drilled in basalt with the casing to 603 ft (184 m) below land surface and the open hole from 603 to 985 ft (184 to 300 m) below land surface.

Following purging and collection of field measurements, groundwater samples will be collected in accordance with TPR-6570 and MCP-227. Table 2 outlines the typical requirements for containers, preservation methods, sample volumes, and holding times for the planned analytical procedures associated with the sample. These requirements could change as laboratory contracts change. Preservatives will be added to the samples in accordance with current ER or Environmental Monitoring Department policies and procedures.

Details for well purging can be found in TPR-6570 in accordance with the directions of MCP-227.

5.2 Sampling Quality Assurance and Quality Control

In addition to regular samples, up to four types of field QC and two types of laboratory QC samples will be collected or prepared (i.e., duplicates, field blanks, performance-evaluation blanks, equipment rinsates, performance-evaluation samples, and trip blanks). Additional information may be found in the current revision of the QAPjP and the Companywide Plan (PLN) -862, *Performance Evaluation Sample Program Plan.* All ER Program activities will comply with PLN-694, *Project Management Plan, Environmental Restoration Program Management.*

Table 2. Specific sample requirements from the Quality Assurance Project Plan (DOE-ID 2000) for groundwater samples for Radioactive Waste Management Complex routine monitoring.

Analytical Parameter	Container		Preservative	Holding Time[b]
	Volume[a]	Type		
Volatile organics (SW-846-8260)	3 × 40 mL	40-ml glass vial, Teflon-lined cap	4°C and H_2SO_4 to pH < 2	14 days
Contract laboratory program metals—unfiltered	2 L	HDPE bottle	HNO_3 to pH < 2	6 months, Hg 28 days
Nitrate and nitrite	250 mL	HDPE bottle	4°C and H_2SO_4 to pH < 2	28 days
Gamma spectroscopy analysis	0.5 to 2 L[c]	HDPE bottle	HNO_3 to pH < 2	6 months
Gross alpha/beta, U-238, Pu-238, Pu-239/240, Am-241, Np-237, Sr-90	10 L	5-L plastic container	HNO_3 to pH < 2	6 months
Tritium	0.1 to 1 L	HDPE bottle	None	6 months
C-14	0.5 to 1 L	HDPE bottle	None	6 months
Tc-99	0.5 to 1 L	HDPE bottle	None	6 months
I-129	1 L	HDPE bottle	None	28 days

a. The laboratory contracted by the Sample Management Office confirmed that these volumes are sufficient to complete required laboratory quality control samples.

b. The holding times are from the date of collection (40 CFR 136.3, Table II).

c. The volumes vary depending on gamma analysis required.

HDPE = high-density polyethylene.

One duplicate sample will be collected every 20 samples or at a 5% minimum of the total number of samples collected. Duplicates will be collected from the same location using the same technique and will be placed in bottles that have been prepared in the same manner as regular samples.

One field blank sample will be collected at the same frequency as the duplicates. In the event of unexpected field sample contamination, field blanks will be used to check chemical preservation techniques and determine whether contamination was introduced at the sampling location. The water used for field blanks, except for VOC field blanks, will be obtained from the distilled and deionized water supply at Site or town laboratories. The water used for VOC field blanks will be ultra-pure resi-analyzed water. A small amount of either the distilled and deionized or ultra-pure resi-analyzed water is poured into the prepared bottle at each sample site. When the last well sample is collected, the field blank bottle is full.

One performance-evaluation-blank sample will be prepared and submitted with each set of quarterly samples. The performance-evaluation blanks will be specially prepared by either the DOE Radiological and Environmental Sciences Laboratory or a certified and approved performance-evaluation sample vendor subcontracted through the INEEL SMO. The performance-evaluation blanks will remain closed during the entire sampling event. The bottles will be opened only in the laboratory during initial sample preparation and for final analysis. In the event of unexpected field sample contamination the sealed performance-evaluation blanks will be used to determine whether the contamination was introduced at the laboratory, thereby monitoring laboratory quality assurance.

One trip blank sample will be prepared in an INEEL laboratory prior to the start of the sampling event using ultra-pure resi-analyzed water and will remain unopened throughout the sampling event. Trip blanks will only be prepared for VOC sampling events and used to monitor VOC contamination in the event of unexpected field sample contamination.

The performance-evaluation samples will be prepared by the DOE Radiological and Environmental Sciences Laboratory or a certified and approved performance-evaluation sample vendor subcontracted through the INEEL SMO and submitted blind to the analyzing laboratory. The performance-evaluation samples will be collected at the same frequency as the performance-evaluation blanks. The performance-evaluation samples will be used to monitor the accuracy and precision of the laboratory's analytical methodology.

Equipment rinsate samples will be collected at the sample port manifold before decontamination, per sampling event, and before the next use. In the event of unexpected field sample contamination equipment rinsates will be used to determine whether contamination is from the sampling equipment.

5.3 Corrective Action

Corrective actions will be required whenever established control limits for an analysis are exceeded. To minimize corrective actions, the groundwater monitoring wells will be controlled (i.e., capped and locked) in accordance with MCP-9279, and a logbook detailing sample-location visitors will be maintained in accordance with MCP-231, "Logbooks for ER and D&D&D Projects." Documentation of such corrective action is required and will be addressed in accordance with MCP-598, "Corrective Action System," and MCP-2811, "Design Control."

6. SAMPLE HANDLING AND ANALYSIS

After groundwater samples are collected from the well and the required preservatives are added (see Section 5.1), the gloved sampling technician will wipe the sample containers to remove any residual water and will relinquish the samples to the designated sample custodian. The sample custodian will be responsible for ensuring that (1) clear tape is placed over sample container labels, (2) lids are secured, (3) parafilm is placed around lids (excluding volatile organic analysis samples), and (4) samples are properly packaged before shipment. The MCP-244, "Chain-of-Custody, Sample Handling, and Packaging for CERCLA Activities"; MCP-2864, "Sample Management"; and TPR-6542, "Handling and Shipping Samples"; contain additional sample-custody information.

6.1 Field Sample Screening Analysis

Groundwater samples have been collected periodically from the RWMC perimeter wells since October 1992 (Becker et al. 1996; Becker et al. 1998). Based on the process knowledge from the previous monitoring results, RWMC perimeter well samples will be well below the U.S. Department of Transportation (DOT) classification of radioactive material and will not require a field sample gamma radiation screen or an offsite laboratory shipping screen. However, gamma screening will be required for samples collected from Well M17S located inside the SDA until a determination is made otherwise.

6.2 Sample Shipping and Laboratory Analysis

Samples will be transported in accordance with the regulations issued by the DOT (49 CFR 171 through 178) and the EPA sample handling, packaging, and shipping methods (40 CFR 261). All samples will be packaged and transported in a manner that protects the integrity of the sample and prevents sample leakage in accordance with MCP-244 and TPR-6542. Packaging procedures will vary depending on results of the radiological screening, the suspected sample concentrations, and the DOT hazard classification.

The temperature of one sample cooler per cooler shipment will be observed upon arrival at the analytical laboratory. This cooler will be opened and a thermometer placed inside. When the thermometer equilibrates, the temperature will be recorded in a logbook in accordance with MCP-9227, "Environmental Log-Keeping and Practices." Laboratory personnel will communicate the temperature to field personnel to ensure adequate coolant is used during subsequent sample shipments as required.

7. DOCUMENTATION

The elements of sample documentation covered in this section are described in detail in the QAPjP (DOE-ID 2000). The FTL or designee is responsible for controlling and maintaining all field documents and records and ensuring that all required documents will be submitted to the ER Document Control coordinator in accordance with guidelines outlined in MCP-227.

Field changes will be implemented by the FTL in accordance with MCP-227 and MCP-135, "Creating, Modifying, and Canceling Procedures and Other DMCS-Controlled Documents." In accordance with TPR-6533, "General Sampling Activities," and MCP-9227, all entries will be made in indelible black ink, all errors will be corrected by drawing a single line through the error and entering the correct information, and all corrections will be initialed and dated.

The serial number or identification (ID) number and disposition of all controlled documents (e.g., chain-of-custody [COC] records) will be noted in the ER Document Control logbook. If any documents are lost, a new document will be completed. The loss of a document and an explanation of how the loss was rectified will be recorded in the ER Document Control logbook. The serial number and disposition of all damaged or destroyed field documents will also be recorded. All voided and completed documents will be maintained in a project file until project completion, at which time all logbooks, unused sample tags and labels, and COC copies will be submitted to the SMO.

7.1 Field Documentation

Other field documents will be required in addition to the FSP, the QAPjP, the OU 7-13/14 HASP for Routine Monitoring (Dooley and Barrie 1998), and any document action requests (DARs). These documents are listed below and discussed in the following subsections:

- Sample labels
- Chain-of-custody records
- Sample logbook
- Shipping logbook
- Field instrument calibration and standardization logbook
- Field team leader logbook (if deemed necessary by the project manager).

Logbooks will be maintained in accordance with MCP-231 and MCP-9227. All information pertaining to sampling activities will be entered in the logbooks in accordance with MCP-9230, "Environmental Monitoring Quality Records," in addition to TPR-6533. Each entry will be dated and signed by the individual making the entry. All logbooks will be QC checked for accuracy and completeness by the FTL or designee. The completed logbooks must be returned to the SMO field data coordinator within 6 weeks of completion of field activities. The logbooks subsequently are submitted to ER Document Control.

7.1.1 Sample Labels

All sample containers will be identified with waterproof gummed labels. Labels may be affixed to sample containers before they are brought to the field and completed on the actual sample date. The label will contain the sample collection time, collection date, type of preservation used, and type of analysis. When not in use sample labels will remain in the custody of the FTL or designee. This is detailed in MCP-227.

7.1.2 Chain-of-Custody Records

The ER Program COC record, Form 435.20, "ER Program Chain of Custody Form," is a multiple-copy form that serves as a written record of sample handling. Each time custody for a sample changes, any individual relinquishing and receiving the sample will sign a COC record for documentation. Thus a written record to track sample handling will be established. Additional COC information is found in MCP-244.

7.1.3 Sample Logbook

The field team will use a sample logbook to record all samples including quality assurance and QC samples. Sample logbook entries will comply with MCP-231. The nature of sampling activities is such that variations from the procedures will occasionally be required to complete the task. When these small deviations in the procedures are one-time events, a DAR is not necessary or desirable and these variations will be recorded in the sample logbook when an FTL logbook is not used.

7.1.4 Field Instrument Calibration and Standardization Logbook

Each piece of equipment will have a unique logbook to record calibration and standardization data. Team members will record any information pertaining to the calibration of equipment used during this project.

7.1.5 Shipping Logbook

Each sample collected will be entered in the shipping logbook. This logbook will contain log sheets to record the sample ID number, collection date, shipping date, COC number, cooler number, laboratory destination, sample shipping classification, name of shipper, and signature of person performing the QC check.

7.1.6 Field Team Leader Logbook

An FTL logbook will be maintained by the FTL when needed. This logbook will contain a daily account of any information related to the sampling project including problems encountered, deviations from the FSP, justification for field decisions, as well as a visitor log. When the FTL logbook is used and if small variations in the procedures are one-time events, these variations will be recorded in the FTL logbook and a DAR will not be required.

8. HANDLING AND DISPOSITION OF INVESTIGATION-DERIVED WASTE

An examination of four quarters of monitoring data indicates that containerization of purge water is not required for the water from all wells listed in Table 3, except for Well M17S. Therefore, the purge water from these wells may be simultaneously discharged to the ground. Purge water from Well M17S, located inside the SDA, must be initially contained at the wellhead during sampling and transported out of the fenced RWMC area prior to discharge in accordance with MCP-425, "Surveys of Materials for Unrestricted Release and Control of Movement of Contaminated Materials."

Waste also will include PPE and miscellaneous sampling materials (e.g., paper towels, plastic bags, and gloves). Based on previous sampling at the RWMC wells, it is not anticipated that any miscellaneous sampling materials will become contaminated. If contaminated, the waste will be bagged, secured with duct tape, and labeled in accordance with instructions from the radiological control technician. The waste can be stored in the RWMC cargo container pending laboratory analyses if necessary. It is expected that the waste will be handled as conditional industrial waste to comply with the waste disposal and disposition form. Free release will be conducted in compliance with MCP-425.

Cold (nonradiological) waste is sent to the Central Facilities Area landfill or another INEEL-designated solid-waste landfill. Low-level radioactive waste is stored in the WAG 7 Environmental Response, Compensation and Liability Act (CERCLA) storage area in accordance with MCP-3475, "Temporary Storage of CERCLA-Generated Waste at the INEEL." The waste will be evaluated for additional characterization and managed as low-level waste. Final disposition will be coordinated with Waste Generator Services.

The analytical laboratory will hold the unused sample volume for 30 days after data package submission. The laboratory may then dispose of the samples or, in the case of radioactively contaminated samples, return the unused sample volume to the INEEL for disposal, in accordance with MCP-2864.

Table 3. Purge water data from quarterly sampling of groundwater monitoring wells.

Contaminant	Release Limit[a]	Well ID	April 1999	July 1999	October 1999	March[b] 2000
Gross α (pCi/L)	15	M1S	1.75 ± 0.41	1.9 ± 0.55	ND	1.11 ± 0.41
		M3S	NS	2.48 ± 0.49	2.82 ± 0.61	1.74 ± 0.48
		M4D	1.47 ± 0.45	ND	3.05 ± 0.80	ND
		M6S	ND	2.05 ± 0.4	2.53 ± 0.64	ND
		M7S	ND	ND	ND	1.72 ± 0.54
		M10S	ND	ND	ND	ND
		M11S	2.01 ± 0.44	1.89 ± 0.42	1.87 ± 0.55	2.83 ± 0.56
		M12S	2.21 ± 0.56	ND	2.14 ± 0.73	1.49 ± 0.47
		M13S	1.94 ± 0.5	ND	ND	1.59 ± 0.43
		M14S	2.58 ± 0.56	4.13 ± 0.87	2.98 ± 1.04	1.40 ± 0.39
		M15S	NS	NS	NS	1.13 ± 0.43

Table 3. (continued).

Contaminant	Release Limit[a]	Well ID	April 1999	July 1999	October 1999	March[b] 2000
		M16S	NS	NS	NS	1.56 ± 0.48
		M17S	NS	NS	NS	1.42 ± 0.57J
Gross β (pCi/L)	50	M1S	2.78 ± 0.47	2.38 ± 0.54	3.66 ± 0.81	3.44 ± 0.52
		M3S	NS	2.79 ± 0.43	3.26 ± 0.44	2.45 ± 0.65
		M4D	14.2 ± 0.7	15.70 ± 0.85	5.39 ± 0.56	21.3 ± 1.64
		M6S	4.41 ± 0.8	1.83 ± 0.32	4.70 ± 0.46	3.93 ± 0.64
		M7S	3.67 ± 0.75	2.90 ± 0.68	3.42 ± 0.75	2.74 ± 0.71
		M10S	3.44 ± 0.74	5.31 ± 0.96	3.6 ± 0.47	3.85 ± 0.75
		M11S	3.15 ± 0.48	3.6 ± 0.41	3.0 ± 0.39	2.37 ± 0.65
		M12S	3.68 ± 0.49	4.70 ± 0.89	3.0 ± 0.43	3.21 ± 0.71
		M13S	2.78 ± 0.47	2.96 ± 0.9	2.9 ± 0.40	4.38 ± 0.60
		M14S	2.99 ± 0.46	3.47 ± 0.47	3.4 ± 0.45	2.19 ± 0.53
		M15S	NS	NS	NS	3.51 ± 0.62
		M16S	NS	NS	NS	2.62 ± 0.69
		M17S	NS	NS	NS	2.21 ± 0.51
Tritium (pCi/L)	20,000	M1S	ND	ND	ND	ND
		M3S	1,600 ± 177	1,700 ± 215	1,470 ± 189	1,690 ± 168
		M4D	ND	ND	ND	ND
		M6S	ND	ND	ND	ND
		M7S	1,400 ± 160	1,280 ± 187	1,150 ± 159	1,320 ± 150
		M10S	ND	ND	ND	ND
		M11S	ND	ND	ND	ND
		M12S	1,570 ± 174	1,390 ± 188	1,660 ± 205	1,500 ± 159
		M13S	ND	ND	ND	ND
		M14S	1,710 ± 187	1,740 ± 216	150 ± 192	1,860 ± 177
		M15S	NS	NS	NS	ND
		M16S	NS	NS	NS	1,020 ± 137
		M17S	NS	NS	NS	688 ± 96.1
Chloroform (µg/L)	100	M1S	ND	ND	ND	ND
		M3S	0.2	ND	ND	ND
		M4D	ND	ND	ND	ND

Table 3. (continued).

Contaminant	Release Limit[a]	Well ID	April 1999	July 1999	October 1999	March[b] 2000
		M6S	0.2	ND	ND	ND
		M7S	0.5	0.5	ND	ND
		M10S	ND	ND	ND	ND
		M11S	ND	ND	ND	ND
		M12S	ND	ND	ND	ND
		M13S	ND	ND	ND	ND
		M14S	ND	ND	ND	ND
		M15S	NS	NS	NS	ND
		M16S	NS	NS	NS	ND
		M17S	NS	NS	NS	ND
1,1,1-trichloroethane (μg/L)	200	M1S	ND	ND	ND	ND
		M3S	0.3	ND	ND	ND
		M4D	ND	ND	ND	ND
		M6S	0.1	ND	ND	ND
		M7S	0.6	0.7	1	ND
		M10S	ND	ND	ND	ND
		M11S	ND	ND	ND	ND
		M12S	ND	ND	ND	ND
		M13S	ND	ND	ND	ND
		M14S	0.1	ND	ND	ND
		M15S	NS	NS	NS	0.30
		M16S	NS	NS	NS	2.2
		M17S	NS	NS	NS	ND
Carbon tetrachloride (μg/L)	5	M1S	ND	ND	ND	ND
		M3S	2	3	ND	3
		M4D	ND	ND	ND	ND
		M6S	1	ND	ND	3
		M7S	4	6	8	7
		M10S	0.2	ND	ND	ND
		M11S	ND	ND	ND	ND
		M12S	ND	ND	ND	ND

Table 3. (continued).

Contaminant	Release Limit[a]	Well ID	April 1999	July 1999	October 1999	March[b] 2000
		M13S	ND	ND	ND	ND
		M14S	0.8	ND	ND	2
		M15S	NS	NS	NS	0.97
		M16S	NS	NS	NS	5.7
		M17S	NS	NS	NS	1.7
Trichloroethene (µg/L)	5	M1S	NA	ND	ND	ND
		M3S	NA	ND	ND	ND
		M4D	NA	ND	ND	ND
		M6S	NA	ND	ND	ND
		M7S	NA	1	3	2
		M10S	NA	ND	ND	ND
		M11S	NA	ND	ND	ND
		M12S	NA	ND	ND	ND
		M13S	NA	ND	ND	ND
		M14S	NA	ND	ND	ND
		M15S	NS	NS	NS	NA
		M16S	NS	NS	NS	NA
		M17S	NS	NS	NS	NA
Tetrachloroethene (µg/L)	5	M1S	ND	ND	ND	ND
		M3S	0.1	ND	ND	ND
		M4D	ND	ND	ND	ND
		M6S	ND	ND	ND	ND
		M7S	0.3	ND	ND	ND
		M10S	ND	ND	ND	ND
		M11S	ND	ND	ND	ND
		M12S	ND	ND	ND	ND
		M13S	ND	ND	ND	ND
		M14S	ND	ND	ND	ND
		M15S	NS	NS	NS	NA
		M16S	NS	NS	NS	NA
		M17S	NS	NS	NS	NA

Table 3. (continued).

Contaminant	Release Limit[a]	Well ID	April 1999	July 1999	October 1999	March[b] 2000
Chromium (μg/L)	100	M1S	27.3	26	28.5	28.8
		M3S	14.4	14	13.8	14.5
		M4D	8.8	7	6.8	6.7
		M6S	20.3	21.3	26.8	24.5
		M7S	12.2	12.6	11.2	11.1
		M10S	11	16.5	14.7	17.8
		M11S	10.1	10	9.0	10.6
		M12S	17	15.2	15.6	16.2
		M13S	18.3	11.8	10.3	11.6
		M14S	15.5	16.2	15.4	15.7
		M15S	NS	NS	NS	27.5
		M16S	NS	NS	NS	13
		M17S	NS	NS	NS	21.8
Mercury (μg/L)	2	M1S	ND	ND	ND	ND
		M3S	ND	ND	ND	ND
		M4D	ND	ND	ND	ND
		M6S	ND	ND	ND	ND
		M7S	ND	ND	ND	ND
		M10S	ND	ND	ND	ND
		M11S	ND	ND	ND	ND
		M12S	ND	ND	ND	ND
		M13S	ND	ND	ND	ND
		M14S	ND	ND	ND	ND
		M15S	NS	NS	NS	ND
		M16S	NS	NS	NS	ND
		M17S	NS	NS	NS	ND
Nitrate (μg/L)	10,000	M1S	850	1,100	1,000 U[c]	630
		M3S	820	790	1,000 U	620
		M4D	450	520	1,000 U	450
		M6S	1,200	1,300	1,300	1,200
		M7S	710	1,100	1,000 U	660
		M10S	680	560	1,000 U	160

Table 3. (continued).

Contaminant	Release Limit[a]	Well ID	April 1999	July 1999	October 1999	March[b] 2000
		M11S	330	370	1,000 U	380
		M12S	830	850	1,000 U	820
		M13S	340	350	1,000 U	300
		M14S	840	820	1,000 U	690
		M15S	NS	NS	NS	1,000
		M16S	NS	NS	NS	790
		M17S	NS	NS	NS	450

a. The value is either an established maximum contaminant level or a proposed maximum contaminant level.

b. Well M17S was sampled in May 2000.

c. A laboratory error resulted in a detection limit of 1,000 ppb. This error was documented in an interoffice memorandum from D. N. Thompson to M. E. Feldman, December 8, 1999, "Transmittal of the Limitations and Validation (L&V) Report Pertaining to Inorganic and Miscellaneous Classical Analysis (I&MCA) of Samples Collected in Support of Waste Area Group (WAG) 7 Groundwater Monitoring—October 1999 Sampling, Sample Delivery Group (SDG) # RIJ0101N2–DNT-146-99."

Key:
J = analyte was positively identified but the associated numerical value may not accurately represent the actual amount present in the sample
NA = not analyzed
ND = not detected
NS = no sample was collected during the quarter beginning with the month shown
U = concentration was below the noted detection limit